

RESEARCH ON ENVIRONMENTAL DEGRADATION IN RIVER BRANCHES AREAS

CERCETĂRI PRIVIND DEGRADAREA MEDIULUI ÎN ZONELE DE RAMIFICARE A ALBIILOR DE RÂU

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Abstract. *The conservation of the ecological system of riverbeds is a necessity for ensuring the living conditions of the aquatic and riparian habitat. A number of special problems are imposed by the riverbed branches where an island is created. The research carried out on the lower course of the Moldova River, where the riverbed was artificially branched (Cordun area, Neamț County) highlighted the need for a set of works on ecological restoration of the aquatic and riparian environment. The presence of economic disturbances in these areas (water capture) has led to significant morphological changes on the two arms of the Moldova River. The aquatic vegetation is almost completely degraded on the active arm of the river. The secondary arm of the riverbed has a variable flow over time, a situation that generates unviable living conditions for the habitat.*

Key words: aquatic environment, ecological restoration, island

Rezumat. *Conservarea sistemului ecologic al albiilor de râu este o necesitate pentru asigurarea condițiilor de viață a habitatului acvatic și riveran. O serie de probleme speciale sunt impuse de ramificațiile de albie unde se crează un ostrov. Cercetările efectuate pe cursul inferior al râului Moldova, unde albia a fost ramificată în mod artificial (zona Cordun, județul Neamț) au evidențiat necesitatea realizării unui set de lucrări privind restaurarea ecologică a mediului acvatic și riveran. Prezența factori perturbatori de tip economic în aceste zone (captare de apă) a determinat modificări morfologice importante pe cele două brațe a râului Moldova. Vegetația acvatică este degradată aproape în totalitate pe brațul activ al râului. Brațul secundar al albiei prezintă un debit variabil în timp, situație ce generează condiții neviabile de viață pentru habitat.*

Cuvinte cheie: mediu acvatic, ostrov, restaurare ecologică

INTRODUCTION

The environment has always been influenced by natural risk factors. Over time, anthropogenic risk factors have been added to natural factors. The cumulation of the action of the two risk factors determines negative effects on the environment.

Environmental protection in the area of hydro-urban works in the riverbed is necessary given the negative impact of the operation of buildings and facilities (Law 137, 1995). Hydro-urban constructions for capturing water from rivers

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require a series of works to arrange the riverbed that disrupts the living conditions of the aquatic and riparian habitat (Bica, 2000).

The paper presents the results of research on environmental degradation in the area of works for water capture in the Moldova riverbed.

MATERIAL AND METHOD

The studies and researches were carried out on a section of the Moldova river located in the area of Cordon locality from Neamț county (fig. 1). The research material consists of the territory that includes water capture for the industrial area of Roman city. The water catchment is performed on the river bank and includes a series of constructions and installations located in the riverbed and on the shore. The execution of the catchment required the construction of a secondary arm of the river to ensure the transit of flows during the working period (Luca, 2011).

The Moldova River has a weakly meandering route in the study area. The river sector considered in the analysis presents an orientation N W - S E. The hydrological research analyzed the parameters of the maximum flow on the river section taking into account the flows registered at the Roman Hydrometric Station, Neamț County.

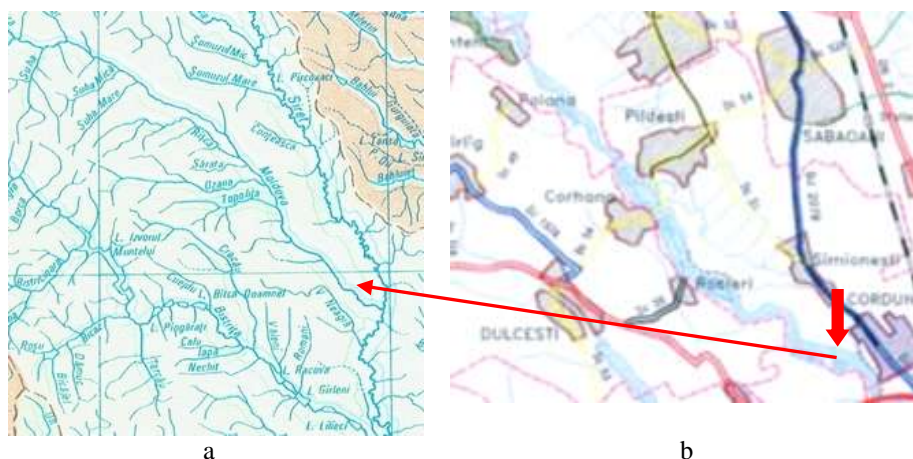


Fig. 1 Location of the study area: a - area of the researched hydrographic basin; b - administrative map of the catchment site

Research was carried out on the river section between 2011 and 2019 in order to analyze the behaviour of the Moldova Riverbed in ensuring the optimal conditions for environmental protection in the catchment area.

Theoretical and experimental research was carried out in the following directions:

1. Research on the influence of natural factors on the morphological transformations of the riverbed and which have a negative impact on the aquatic and riparian environment.

2. The study of the influence of anthropogenic factors on the aquatic and riparian environment on the two riverbed sections resulting from the groundwater capture.

The analyzed data were taken from technical expertise performed for water abstraction from the Moldova River, as well as fine specialized documentation on the field of study. In the field, the structural and functional state of the two arms was analyzed by topographic, hydrological, geotechnical studies, etc. The field research carried out photo

surveys during the ten years of study to follow the evolution of environmental characteristics.

RESULTS AND DISCUSSIONS

The structure of the water catchment includes a series of constructions and installations located in the riverbed and on the shore. The construction of the catchment imposed the division of the river into two arms by creating an island in the area of Cordun locality (fig. 2). The flows on the secondary arm of the river were transited during the execution period. The secondary arm remained on the route of the Moldova River after the completion of the water catchment. The main water flow flows through the left arm of the river, and the right (secondary) arm is fed intermittently, especially at high flows (fig. 3) (Luca, 2011).

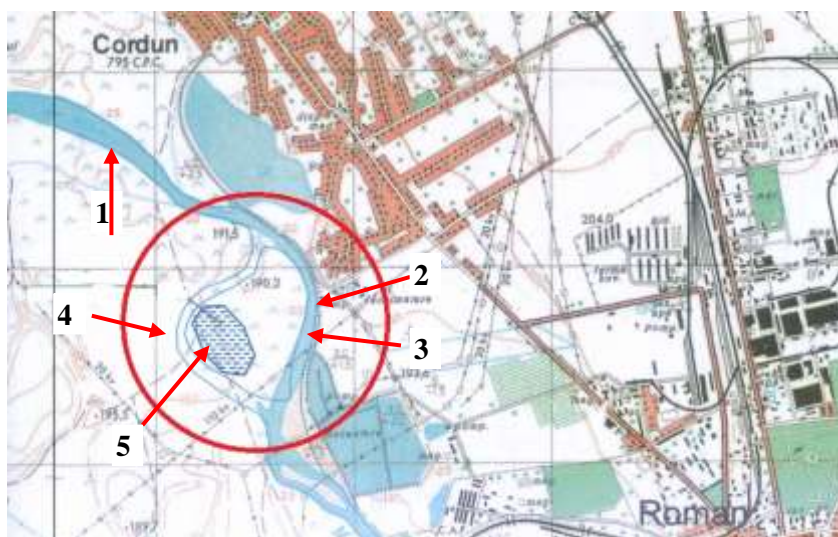


Fig. 2 Location of the research area on the Moldova River in the Cordun area, Neamț County; 1 - Moldova River; 2 - water capture; 3 - main riverbed (left arm); 4 - secondary bed (right arm); 5 - island (Luca 2011)

The catchment consists of constructions and installations made along the river that have the role of taking over calibrated flows over periods of time. The constructions and installations are the following: canal, capture windows, dams. The constructions executed in the riverbed consist of bottom sill, energy dissipator, downstream apron and shore protections. The right arm is made in the form of a calibrated river section. The water catchment influenced the morphology of the minor riverbed of the Moldova River on a length of about 400 m.

An island with an area of 21.0 ha was formed between the two riverbeds. It is positioned at approx. 6.00 km upstream of the confluence of the Moldova river with the Siret River (fig. 3).

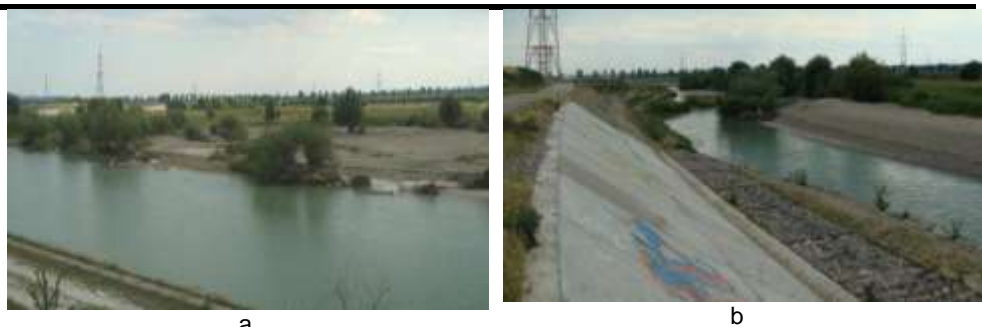


Fig. 3 General view of the island formed by the branching of the Moldova River bed; a - upstream area of the island; b - the main riverbed and the island in the central area (photo Sion 2019)

The left arm of the river on a length of 320 m is rectilinear and has a calibrated section. The water flow occurs at high speeds (about 1.29 - 2.60 m / s, up to 4.0 m / s), a situation that strongly influences the environmental protection conditions.



Fig. 4 General view of the Moldova river upstream of catchment: a - riverbed before branching; b - the entrance on the secondary riverbed with the position of the overflow; 1 - spill (photo Sion 2019).

The research highlighted the following:

- the main riverbed has a route in the form of a circular arc with a large curvature to ensure the supply of water catchment located on the river bank (fig. 4.a, fig. 5);
- the high speed of the water does not allow the formation and preservation of the living conditions of the flora and fauna;
- the calibrated riverbed is protected on a long length with rigid elements (concrete slabs, gabions, stone), a situation that does not allow the creation of an alluvial layer for the growth of aquatic flora;
- the riverbed calibrated and packed with rigid elements does not allow the fulfillment of the conditions for the growth of the aquatic fauna: in the riverbed it is not possible to create areas of rest of the fish, of reproduction and growth;



Fig. 5 Constructive characteristics of the Moldova River bed in the catchment area: a - general view; b - the energy dissipation basin at the bottom threshold (photo Sion 2019)

- the canopy area is continuously degraded and polluted with dust, aerosols, hydrocarbon residues, household and industrial waste, mainly due to road transport adjacent to the canopy.

The secondary riverbed (right arm of the river) is fed only at medium and high flows. The entrance to the secondary riverbed is arranged in the form of an overflow (temporary construction). The cross section of the riverbed is variable in size and length. The riverbed consists of layers of ballast over which fine alluvium is deposited. The analysis performed in the field highlighted the following:

- the secondary riverbed has a linear sector at the entrance, followed by a sector in the shape of a circular arc, and the exit sector is slightly curved (fig. 6);
- the cross section of the right arm is variable in size and length;
- the aquatic environment on the right arm is degraded in the current stage; a negative influence is the exploitation of the ballast on the secondary riverbed;



Fig. 6 The characteristics of the secondary riverbed of the Moldova River: a - the entrance section; b - the central section (photo Sion 2019)

- the morphology of the right arm is continuously modified at maximum flows, but also at the average flows that enter temporarily due to the degradation of the spillway.

- morphological changes produce areas of erosion and alluvium deposition along the length of the right arm;
- water stagnates in some sectors and creates an anaerobic environment, which influences the development of the aquatic environment;
- on the right arm there is an aquatic habitat developed in a minor stage, but affected by the water flow conditions; ensuring a stable water level can be done by running a spillway in the area where the right arm joins the left;
- the aquatic habitat in the secondary riverbed is strongly disturbed by the absence of riverbed arrangement works and the permanent impact of the maximum flow;
- the research highlighted an influx of water in the secondary riverbed produced by the underground current that crosses the ballast layer between the two riverbeds.

The presence of the island allows the creation of a habitat for protected species in the riparian area. Ecological restoration is a solution to restore the riverbed branches of an island in order to achieve adequate protection of aquatic and riparian flora and fauna (Petts and Calow, 1996; Serban, 1999).

CONCLUSIONS

The river sectors occupied with water catchment constructions do not achieve favorable existence of the aquatic and riparian habitat, situation in which measures must be adopted for the ecological reconstruction of the riverbed-riparian zone environment.

The impact on the environment given by the rigid works of riverbeds is extremely negative and greatly disrupts the living conditions of the aquatic habitat.

The branched riverbeds of the rivers due to the location of the hydrotechnical constructions work differently in order to ensure the optimal parameters for the development of the aquatic and riparian environment.

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